CAPITAL PROJECT JUSTIFICATION 2009-2010

JOB.NO: W.O. #

TITLE: Variable Frequency Drives (VFDs) for Condensate Pumps

DESCRIPTION: Install VFDs for each of the six (6) Condensate Pump Motors.

JUSTIFICATION: ECONOMIC

RATE OF RETURN:	12.8 %
PAYBACK PERIOD:	8.8 years
BENEFIT/COST RATIO:	1.70
ECONOMIC LIFE:	20 years
PV SAVINGS:	$2,744,000
SALVAGE VALUE:	$0

ADDITIONAL DETAIL: This project includes adding a variable frequency drive (VFD), an electronic controller that reduces electrical energy consumption by properly matching the pump motor speed to load demand. The units operate two of the three pumps at full load, so the VFD benefit is estimated that two pumps would run at 80 percent capacity. This results in savings of 1,044 kW across both units, at a uniform capital savings of $457,300 from reduction in auxiliary power used.

COST ESTIMATE:

	09-10 ~~10-11~~	10-11 ~~11-12~~	line totals
Engineering Labor	$ 20,000	20,000	40,000
Installation Labor	$ 20,000	20,000	40,000
Contractor Labor	$ 620,000	620,000	1,240,000
Material	$ 1,310,000	1,310,000	2,620,000
Job Total	$ 1,970,000	1,970,000	3,940,000

[redacted]

IP12_004626

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ALTERNATIVES:

EFFECT OF DEFERRAL: If there were a 20 dollar per ton CO2 tax the payback goes to 5.2 years. If it were 40 dollars per CO2 tax the payback goes to 3.7 years.

PROJECT HISTORY:

[redacted]

For the VFD installation on the condensate pump motors

	QTY	labor & material	total
New 6.9kV breaker protection relays+ install	6	$25,000.00	$150,000.00
Install	6	$20,000.00	$120,000.00
VFD with disconnect switch vendor said $240K	6	$310,000.00	$1,860,000.00
VFD installation	6	$60,000.00	$360,000.00
power feeds cable + tray ($15/ft)	6	$15,000.00	$90,000.00
Installation of power feed	6	$10,000.00	$60,000.00
HVAC for VFD rooms and VFDs	2	$90,000.00	$180,000.00
Contract for installation of miscellaneous	2	$100,000.00	$200,000.00
enclosure	2	$80,000.00	$160,000.00
Installation of enclosure	2	$60,000.00	$120,000.00
Building aux power lighting	2	$20,000.00	$40,000.00
Labor for lighting and auxiliary power install	2	$20,000.00	$40,000.00
controls installations and mat	6	$20,000.00	$120,000.00
Labor for controls	6	$20,000.00	$120,000.00
engineering labor	1	$40,000.00	$40,000.00
Labor for contingencies	1	$100,000.00	$100,000.00
aux power feeds each fan	6	$30,000.00	$180,000.00
		total	$3,940,000.00

Economic Calculation

Project Title: Condensate Pump VFD Project

Work Order:

Date: August 8, 2008

Assumptions:

$n := 20$	Expected Equipment/Project Life
$P_0 := 394000\,dollars$	Initial Project Cost
$L_0 := 0\cdot dollars$	Salvage Value of Old Equipment
$S_0 := 0\cdot dollars$	Initial One Time Savings
$Q_c := 0\cdot ton$	Uniform Annual Coal Savings
$Q_{fo} := 0\cdot gal$	Uniform Annual Fuel Oil Savings
$Q_p := 0\cdot MW\cdot hr$	Uniform Annual Power Savings
$S_m := (457272+0)\cdot dollars$	Uniform Misc Annual Savings
$C_a := 10000\,dollars$	Uniform Annual O&M Costs of New Equipment
$L_n := 0\cdot dollars$	Future Salvage Value of Equipment at the End of the Project Life

Notes: S

According to the "Greenhouse Gas Reduction Feasibility Study - Task 1 Improve Efficiencies" from B&V we can get 1.044MW across both units by operating the two (2) condensate pumps at 80%.

$1.044\,50\cdot 8760 = 457272$ dollars per year $\qquad M := 10^6$

$$CO_2 := \frac{4400\frac{ton}{yr}\cdot(1.044M\cdot W)}{0.3M\cdot W}$$

$CO_2 = 1.531\times 10^4\cdot\frac{ton}{yr}$ $\qquad tax_{CO2} := 40\frac{dollars}{ton}$

$Total := CO_2\cdot tax_{CO2}$ $\qquad Total = 612480\frac{dollars}{yr}$

Calculations:

Net Project Cost

$P_c := P_o - L_o - S_o$

$P_c = 3940000.00\text{dollars}$

Annual Project Cash Flow - Uniform Portion Only

$S_a := \left(Q_c \cdot C_{coal} + Q_{fo} \cdot C_{fuel\_oil} + Q_p \cdot C_{replace\_power}\right) + S_m - C_a$

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$S_a = 447272.00\text{dollars}$

Fill the Annualized Savings Array - Uniform Annual Project Cash Flow Adjusted for Inflation

$S_t :=$ | $S_0 \leftarrow -P_c$
| $S_1 \leftarrow S_a \cdot \left(1 + i_{inflation}\right)$
| for $i \in 2..n$
| $S_i \leftarrow S_{i-1} \cdot \left(1 + i_{inflation}\right)$
| return S

Future Salvage Entered into the Unequal Savings Array

$S_{unequal_n} := S_{unequal_n} + L_n$

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Fill the Annualized Rate of Return Array - Adjustments Made for Unequal Cost/Savings

$ROR :=$ | $R_0 \leftarrow -P_c$
| for $i \in 1..n$
| $R_i \leftarrow S_{t_i} + fv\left(i_{inflation}, i, 0, S_{unequal_i}, 0\right) - fv\left(i_{inflation}, i, 0, C_{unequal_i}, 0\right)$
| return R

Future

Fill the Annualized Present Value Array - Present Value Calculation on RoR Array

$PPV :=$ | $P_0 \leftarrow -P_c$
| for $i \in 1..n$
| $P_i \leftarrow -pv\left(i_{money}, i, 0, ROR_i, 0\right)$
| return P

Calculate the Net Present Value - Sum the Period Present Value Array

$$NPV := \sum PPV$$

Calculate the Present Value Annuity - Sum the Period Present Value (PPV) Array Minus Net Project Cost (P_c)

$$APV := NPV - PPV_0$$

Calculate the Benefit to Cost Ratio - Present Value Annuity (APV) Divide by the Net Project Cost (P_c)

$$B2C := \frac{APV}{P_c}$$

Calculate the Payback Period - Net Project Cost (P_c) Divided by the Annual Cash Flow (S_a)

$$Payback := \frac{P_c}{S_a}$$

Calculate the Rate of Return - Ratio of Average Annual Cash Flow to Project Cost

$g := 0.1$ Initial Guess

$ROI := irr(ROR, g)$

Results:

Present Value of Project:	NPV = 2744241dollars
Benefit / Cost Ratio:	B2C = 1.70
Payback Period:	Payback = 8.8·years
Rate of Return:	ROI = 12.8·%

From: "Ron Manning" <ron@ritereng.com>
To: <nathan-c@ipsc.com>
CC: "'Ron Manning'" <ron@ritereng.com>
Date: 8/8/2008 3:54 PM
Subject: FW: IPP utah Budget pricing

48 week Lead time

Nathan,

Here are your budget numbers for IPP.
All VFDs are 6.9 kV input, 6.6 kV output. All VFDs are 36-pulse diode rectifier, 13-level PWM. All VFDs include the full ProToPS option package including:

* Copper Transformer
* Power Cell Bypass
* N+1 cooling fans
* Kirk Key Style Interlocks
* EMI per EN Norms
* Ethernet Switch with Optic Isolation

Expected VFD performance is as follows:

* Efficiency
* 4/4 Load - 96.7%
* 3/4 Load - 96.9%
* 1/2 Load 0 96.9%
* 1/4 Load - 96.7%
* Power Factor
* 4/4 to 1/4 Load - 96%+

VFD Options as follows:

* 1750 HP
* GEN III
* 1750 kVA Transformer
* 140 amp power cells - continuous and one minute rating
* Dimensions - (H x W x D) (in) - 116.5 x 157 by 48
* Weight - 12,720 lbs.
* Today Price $ 210,420.00

* 1750 HP
* GEN III
* 1750 kVA Transformer
* 200 amp power cells - continuous and one minute rating
* Dimensions - (H x W x D) (in) - 116.5 x 192 by 48
* Weight - 14,0350 lbs.
* Today Price $ 238,245.00

add 10% contingency 2x5% for each year 6.5% taxes
$310K

* 4000 HP
* GEN IIIe
* 4000 kVA Transformer>
* 315 amp power cells - continuous and one minute rating
* Dimensions - (H x W x D) (in) - 121.21x284x54
* Weight - 33,900 lbs.
* Today Price $ 403,575.00

* 4000 HP
* GEN IIIe
* 4000 kVA Transformer
* 375 amp power cells - continuous and one minute rating
* Dimensions - (H x W x D) (in) - 121.21x284x54
* Weight - 34,800 lbs.
* Today Price $ 409,630.00

For PDCs - 2 VFDs per PDC

* 1750 HP VFDs
* Utilize 3 by 20T HVAC (oversized for ambient - will need a final check when you get the site data)
* N+1 configuration
* PDC Dimensions (approx) (H by W x D) (ft) - 13 1/2 x 28 x 14
* Weight - with VFDs - 65,000 lbs.
* Total Price - $ 240,000

* 4000 HP VFDs
* Utilize 4 by 6T HVAC (oversized for ambient - will need a final check when you get the site data)
* N+1 configuration for internal air and heat load off surface of VFD - VFDs become NEMA 12 non-vent
* PDC Dimensions (approx) (H by W x D) (ft) - 13 1/2 x 38 x 14 - add 8 foot to depth for air-to-air HEX
* Two air-to-air HEXes per VFD (heat pipe design - external air path pipes and fins are polycoat treated for environment)
* Fan system is 2N for internal fans and N+1 for external fans
* Weight - with VFDs - 135,000 lbs.
* Total Price - $ 460,000

Proposal is valid for 60 days. Siemens Standard Terms of Sale apply except warranty is 30/24. Progress payments will apply.

As requested, complete reply by Friday, with 90 minutes to spare.

Best regards,

Ron Manning
Riter Engineering Company
Phone: 801-973-9063
Fax: 801-973-8333
ron@ritereng.com